I. C. 6403 November, 1930

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GEOPHSYICAL ABSTRACTS

NO. XIX

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FREDERICK W. LEE

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DEPARTMENT OF COMMERCE -- BUREAU OF MINES

GEOPHYSICAL ABSTRACTS[1]

No. 19

Compiled by Frederick W. Lee[2]

TABLE OF CONTENTS

Page
1. Gravitational methods 2
2. Magnetic methods 3
3. Seismic methods 7
4. Electrical methods 14
5. Radioactive methods 17
7. Unclassified methods 20
9. New books 25
10. Patents 26

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1. GRAVITATIONAL METHODS

UEBER DIE ABHÄNGIGKEIT DER SCHWERKRAFT VON ZWISCHENMEDIUM

(THE DEPENDENCE OF THE GRAVITATIONAL EFFECT FROM THE INTERMEDIATE LAYERS)

By Teodor Schlomka

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 392-396.

In a previous article (see Geophys. Abs. No. 2, 1929, p. 13) the author reported briefly on his experiment, the purpose of which was to establish whether there is a dependence of the gravitational effect from an intermediate layer upon the "refraction of the gravitational lines of forces" (Kraftlinienbrechung).

In this article Schlomka proves by experiments that the results on this dependence were not influenced by disturbing magnetic forces, and according to his statement the data obtained from torsion-balance measurements were not influenced by the different external magnetic fields. Changes in magnetic fields, even 60 times stronger than the earthmagnetic field, did not cause any disturbing influence upon the results of the measurements.--W. Ayvazoglou.

ON THE EXPANSION OF THE EARTH'S GRAVITY IN POWERS OF THE SQUARE OF THE SINE OF THE LATITUDE

By Corradino Mineo

The Quarterly Journal of Mathematics (Oxford Series),
vol. 1, No. 2, June, 1930.

Assuming that the surface of equilibrium of the earth is an oblate spheroid of revolution, with equatorial radius a and ellipticity e, this paper derives the relation:

$$\frac{g}{g_e} = 1 + \left(\frac{5}{2} m - \frac{1}{2} e^2 - \frac{13}{7} m e^2 \right) \sin^2 \varphi + \left(\frac{5}{4} m e^2 - \frac{1}{8} e^4 \right) \sin^4 \varphi$$

where $m = w^2 a \mid g_e$

w is the angular velocity of the earth,

g_e is the value of gravity on the surface at the equator,

g is the value of gravity on the surface at the latitude φ.

For details, the original paper should be consulted.--Irwin Roman.

2. MAGNETIC METHODS

PRACTICAL GEOMAGNETIC EXPLORATION WITH THE HOTCHKISS SUPERDIP

By Noel H. Stearn

The American Institute of Mining and Metallurgical Engineers,
Technical Publication 370, 1930, 31 pp.

Contents of the article:

1. History. - The Hotchkiss Superdip magnetometer has been evolved as a result of an attempt to carry over into the field of magnetic exploration of anomalies of low magnitude the outstanding advantages of speed and simplicity which are inherent in the ordinary dip needle.

2. Working Principles. - A description and a diagram of working principles of an ordinary dip needle and Hotchkiss Superdip are given.

3. Construction. - A photograph showing the construction and mounting of the Hotchkiss Superdip, as well as a brief description of it, is included. From the specifications given in a table an idea of the bulk and weight of the apparatus can be drawn.

4. Behavior. - The action of the device is illustrated by figures showing (a) the setting of the Hotchkiss Superdip; (b) a typical graph of the instrument behavior throughout its principal working range of sensitivity, and (c) a graph of the practical working sensitivity of a typical instrument, together with the average sensitivity of 14 ordinary dip needles.

5. Field Procedure. - Because a geomagnetic survey is merely a supplement to a geological survey, the field procedure must necessarily depend upon the geological problem to be solved and upon individual ingenuity. A figure shows a typical page of data recorded on a special form designed to offer a concise and complete system of notation.

6. Corrections. - To secure results of maximum precision six different corrections may be applied to the readings. The corrections are for (1) temperature, (2) diurnal variation, (3) day-to-day variation, (4) latitude, (5) longitude, and (6) correction to base. Diagrams showing typical correction curves, combined latitude and longitude correction, and magnetic profiles showing influence of various corrections are given.

7. Application. - Nine cases are cited where the Superdip has been applied in seven different States (Wisconsin, Minnesota, Texas, Oklahoma, Kansas, Arizona, and Arkansas) in connection with geomagnetic methods of exploration for eight different natural resources (copper, iron, oil, gas, lead, gold, bauxite, and diamonds).

In conclusion the author says:

The foregoing examples of the application of the geomagnetic method to exploration by the use of the Hotchkiss Superdip are far from exhaustive even of the types of problems to which the method and the instrument may be applied. Nor is the implication intended that similar results may not be obtainable with other instruments. In categorizing the Superdip, however, it should be borne in mind that the instrument has been designed as a facile tool for the use of mining engineers and economic geologists, and that its use is recommended for magnetic anomalies of an order of magnitude greater than 10 gammas.--W. Ayvazoglou.

GEOMAGNETIC INVESTIGATION OF ALGONKIAN CONTACT DEPOSITS AND GRANITES IN PRIBRAME (IN BOHEMIAN)

By Fr. Čechura

Rozpravy II. Tridy Ceské Akademie, vol. 39, No. 10, 1929, 14 pp.

Contents:

1. Introduction.
2. Topography.
3. Magnetic survey.
4. Interpretation of the data obtained.
5. Results.

A table summarizing the data and two maps are added.--W. Ayvazoglou.

UEBER DIE MAGNETISCHE STÖRWIRKUNG VON EISENKÖRPERN UND EISENMASSEN (SCHACHTANLAGEN, BOHREINRICHTUNGEN, USW.)

(ON THE MAGNETIC DISTURBANCE-EFFECT OF IRON BODIES AND IRON MASSES SUCH AS SHAFT INSTALLATIONS, DRILLING ARRANGEMENTS, ETC.)

By E. Kohl

Kali und verwandte Salze, vol. 24, Nos. 12, 13, and 14, 1930,
pp. 177-181, 93-120, and 212-216.

During the earthmagnetic investigation between the mountain range Salzgitterer and the Oderwaldsattel a strong negative disturbance of the vertical intensity was established above the Flachstöckheimer salt dome. This disturbance could not be assigned exclusively to the influence of salt, thus its explanation caused some difficulties.

In connection with the solution of this problem the author carried out a number of magnetic observations upon iron bodies of different kinds and gives in this article the results of his work.

Observations on the following bodies were made:

1. Simple bodies: (a) Pipes in perpendicular position and single boreholes; (b) horizontal pipes.

2. Combined bodies: (a) Shaft installations, groups of boreholes and installations for working of oil; (b) vehicles of all kinds.

The results of observations are summed up as follows:

The character of disturbance of iron and steel bodies, simple and combined, magnetized by earth induction is, of course, a positive one. But these bodies cause not only a positive disturbance of the vertical intensity but in all cases also a negative one. The relation of these two disturbances, with regard to their order and their mutual position, is different according to the form of the disturbing body and its position in regard to the earth field.

The distance of the disturbance-effect, measured on the surface of the ground, changes with the mass, form, and position of the body.

How far from a disturbance body shall the observer stay during the earthmagnetic investigations in order to avoid errors in the results of measurements depends not only on the distance of the disturbance effect of this body but also on the accuracy of measurements desired.

A series of figures and a table showing the data of observations is added.--W. Ayvazoglou.

EIN UNIVERSAL INDUKTIONS MAGNETOMETER

(A UNIVERSAL INDUCTION MAGNETOMETER)

By W. Uljanin

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 435-442.

This article deals with the construction of an induction magnetometer by the aid of which all the three elements of the earth's magnetism can be determined.

The following items are given:

1. The description of the instrument (a photograph is added).

2. The use of the instrument (schematical design for the measurement of intensity is given).

3. Examination of the instrument.

4. Measurements with the instrument.

5. The projected induction magnetometer.

In conclusion the author discusses the question on the application of the induction magnetometer.--W. Ayvazoglou.

CONSTRUCTION OF MAGNETIC CHARTS

By W. N. McFarland

Terrestrial Magnetism and Atmospheric Electricity,
vol. 35, No. 2, 1930, pp. 73-80.

This article is a review of the methods which have been used by the United States Coast and Geodetic Survey in the construction of the isomagnetic charts which it has published, with comment on the adaptibility of the different methods.--Author's abstract.

A COMPARISON OF MAGNETIC DISTURBANCE AT DIFFERENT STATIONS

By W. F. Wallis

Terrestrial Magnetism and Atmospheric Electricity,
vol. 35, No. 2, 1930, pp. 93-101.

A brief discussion of the magnetic records obtained during the MacMillan Baffin Island Expedition of 1921-22 is given with comparison of results from several other well-disturbed observations. For comparison a short, well-defined, world-wide magnetic storm (March 14, 1922) was selected, and departures from normal values were compiled and compared by three methods: (1) Difference between the disturbed and normal total-intensity vectors; (2) excess energy of the magnetic field due to the disturbance; and (3) magnetic activity proposed by Chree, using absolute daily ranges in three rectangular components of the total magnetic intensity. It is concluded that the geographic distribution of magnetic activity during disturbance bears a close relation to the auroral zone, and there is evidence that the zone of maximum auroral frequency is also a zone of maximum magnetic activity. If we take average values of the disturbance-vectors over several months, there is a marked regularity in their directions for the individual stations, and for all stations the general direction of the horizontal-intensity disturbance-vectors is southward. This indicates that the disturbing currents in the upper atmosphere flow in general from east to west around the earth.--Author's abstract.

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MAGNETOMETER RESULTS IN LEA COUNTY, NEW MEXICO

By L. Spraragen

The Oil and Gas Journal, vol. 29, Nos. 4 and 6, 1930,
pp. 91-92 and 34 and 92-94.

The object of this paper is to show the magnetometer results of measurements carried over into Gaines and Andrews Counties, Tex. From this work the relation of the magnetometer structures in these two counties can be studied with respect to the structures in New Mexico. Six profiles are shown, together with the locations of the stations. A discussion of the profiles is given.

In conclusion the author expresses the opinion that the fact that the magnetometer results are so pronounced and the relief so great should perhaps create additional confidence in the value of the magnetometer for certain areas, providing, of course, that such relief is in some way connected with the geology for that area.--W. Ayvazoglou.

3. SEISMIC METHODS

UEBER DIE FORM DER FERNSCHALLWELLE

(ON THE FORM OF DISTANT SOUND WAVE)

By W. Kühl

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 358-361.

The remarkable changes of form which sound waves produced by explosion undergo in the atmosphere have not been considered sufficiently. The form of the wave was examined mostly from the viewpoint of technics of explosion, and the observations were made close to the place of explosion. The great variety wave forms at a certain distance resulted, of course, in their being classified empirically into certain types, but only a few attempts were made to explain and utilize these types. The reason for neglecting this problem was mainly that the form of the waves reproduced in the receiving instruments was generally thought to be too distorted to allow the reduction of curves to the true course of pressure.

In this article the author shows that, although imperfect, the registration of the receiving instruments now in use is sufficiently good for making the necessary conclusions on the form of waves. Several examples of typical and remarkable distant sound wave curves are reproduced and discussed.--W. Ayvazoglou.

A PROPOSED ACCELEROMETER FOR USE IN A SEISMIC REGION

By Frank Wenner

Eastern Section of the Seismological Society of America,
Proceeding of the 1930 Meeting, Washington, D. C., pp. 46-51.

The author describes the construction of an instrument from which th earth movements can be determined to the precision required in engineering calculations:

a. A steady mass consisting essentially of a rectangular loop of copper wire approximately 1 centimeter wide and 3 centimeters long, and having a mass of about 1 gram.

b. Supports for the steady mass of the torsion type in line with one of the longer sides of the rectangle and of such stiffness as to give a period of 0.1 second.

c. Damping by means of a cobalt steel magnet so located that movement of the steady mass or rectangle with respect to the support results in an electric current in the loop.

d. Photographic registration, using a mirror located near the axis of the moving system and photographic paper at a distance of 50 centimeters fro the mirror. The timing clock and photographic paper to be started in motion and the lamp turned on by an acceleration in excess of some selected magnitude, such for example as 0.03 gravity.

The added figures show: (1) For different degree of damping, the manner in which the displacement shown on the record approaches its final magnitude in case of a suddenly applied acceleration of 0.04 gravity; (2) in case of 0.625 critical damping, the way in which the amplitude of the displacement shown on the record depends upon the period of the earth movement, assuming a harmonic acceleration having an amplitude of 0.04 gravity; and (3) the log of the displacement. Based on the figures given in the article the author is of the opinion that an instrument of the type described (if the damping is in the neighborhood of 0.625 critical) would not only be suitable for the purpose mentioned above but would give directly the accelerations, which are what the engineer most desires to know; these accelerations would be recorded with sufficient accuracy so that both the velocities and the displacements could be determined from them with fair accuracy.--W. Ayvazoglou.

A SERVICEABLE SCALE FOR EARTHQUAKE INTENSITY

By Alexander McAdie

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 54-56.

In discussing the question concerning the estimation of earthquake intensity, the author says that while it is fully recognized that objection can be made to the employment of acceleration at any given point as a basis for estimating earthquake intensity, in view of the fact that no other quasi scientific scale has been suggested, he offers the following:

First, to prepare a decimal scale, the minimum value 1 representing an acceleration of 1 millimeter per second per second, and the maximum 10 an acceleration of 10,000 millimeters per second per second, which, with a little squeezing, is practically the acceleration of gravity at sea level in latitude 45°. If the new dynamic meter is used, the scale fits nicely. The scale is in accord with c.g.s. units, a great gain, and international in character.

The author suggests coining the word kilogal to represent the extreme acceleration in a catastrophic earthquake, the prefix kilo meaning one thousand, and the second syllable being the first letters of Galileo; in the same way the word milligal can be used for the feeblest acceleration, the range being one million units of acceleration.

Proposed scale for earthquake-intensity

(Compare with Mercalli-Cancani intensity scale)

Intensity	Description	Acceleration	
		Milligals	Mm. per sec.^{2}
1	Earthquake detectible only by instruments	1 to 5	0.01 to 0.05
2	Very feeble	5 to 10	0.05 to 0.10
3	Feeble	10 to 50	0.1 to 0.5
4	Noticeable but no damage	50 to 100	0.5 to 1.0
5	Felt generally	100 to 500	1 to 5
6	Slight damage	500 to 1,000	5 to 10
7	Walls cracked	1,000 to 10,000	10 to 100
8	Badly built houses destroyed	10,000 to 50,000	100 to 500
9	Violent; much destruction and loss of life	50,000 to 100,000	500 to 1,000
10	Catastrophic	100,000 to 1,000,000	1,000 to 10,000

W. Ayvazoglou.

A TABLE OF TRAVEL TIMES FOR NEAR EARTHQUAKES

By J. S. Joliat

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 56-59.

The author draws attention to the well-known fact among seismologists that there is a striking difference between the seismograms of the same earthquake as recorded at nearer and more distant stations, and points out some other anomalies in the near earthquake record which make its interpretation difficult.

Means for elucidation of this problem are discussed.—W. Ayvazoglou.

SOME CHARACTERISTICS OF RAYLEIGH-WAVE RECORDS ON SEISMOGRAMS OF DISTANT EARTHQUAKES

By L. Don Leet

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., p. 60.

An abstract of L. Don Leet's article, communicated by E. A. Hodgson, is given; it is expected that the complete paper will appear in a publication of the Dominion Observatory, Ottawa, Canada.

The abstract reads as follows:

In the course of an investigation of surface-wave records recently completed by the writer at the Dominion Observatory, Ottawa, several characteristics of Rayleigh-wave records were studied.

Satisfactory evidence was not found of the existence of types of induced surface-waves other than the previously known Q, or transverse, and Rayleigh waves, though specific search was made for some of the complex forms shown by Uller to be mathematically possible.

The path of the earth particle during the passage of Rayleigh waves was found to be that required by the theory of Rayleigh--an ellipse traversed in a retrograde sense as regards the direction of propagation of the disturbance.

Evidence was found that in general the "maxima," or "M" portions, so-called, owe their character to fortuitous fluctuations in the phase, period, and amplitude of transverse and longitudinal motions which combine to cause them. As a result, unless a station is equipped with a vertical seismograph, its records do not give a reliable indication of the onset, duration or character of Rayleigh waves, for quakes which are not "end-on" with respect to the instrument's orientation. This would suggest that the reading of "M" for the bulletins of seismograph stations is meaningless.

No inherent identity was found between the surface phases of quakes from a given region, or difference between those of comparable distances from different epicentral regions. It is believed that many apparently unique characteristics are for the most part functions of the azimuth of the quake from the recording station, coupled with the orientation of the instruments.

It is suggested, as a result of this study, that recording stations, to render optimum service, should orient at least some of their instruments with reference to one or more epicentral regions from which most of its records are obtained, rather than in the traditional NS - EW planes.--E. A. Hodgson.

A TILT-COMPENSATION SEISMOMETER

By H. E. McComb

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 60-63.

The need of a seismometer of moderate magnification (100 or less) is considered, which would record practically all of the major quakes, would not be put out of commission by the light local disturbances, and would be practically free from the effects due to slow tilt. The author used the simplest method for making test of such a seismometer by applying to existing equipment a modification of a compensation-device used by Dr. Romberg at the University of Hawaii. Accordingly, a 10-kilogram Bosch-Omori horizontal pendulum was modified for photographic registration and tilt-compensation. No changes were made in the column, upper or lower supports, pivots, boom, or steady mass. Tho balance of the instrument was entirely rebuilt.

The arrangement for obtaining the desired magnification is described and given in a figure. Figures showing (1) the decay-curve made by tilt-compensation seismometer; (2) record of rapid oscillations made by tilt-compensation seismometer; (3) record by tilt-compensation seismometer, October 1, 1929, showing damping test and microseisms and (4) plan for mounting two horizontal-component seismometers accompany the description.--W. Ayvazoglou.

INSTALLATION OF NEW SEISMOGRAPHS AT THE MANILA OBSERVATORY

By W. C. Repetti

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 63-65.

The installation of a set of Galitzin-Wilip seismographs at the Manila Observatory, Philippine Islands, is described.--W. Ayvazoglou.

THE EARTHQUAKE, A JOINT PROBLEM OF THE SEISMOLOGIST AND ENGINEER

By N. H. Heck

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 42-46.

In this article the author discusses the interrelation of the work of the seismologist and engineer. In conclusion he says:

> "I see the earthquake problem as one great problem the parts of which are all interrelated. Some portions of the problem seem far removed to others, but I think that the greatest progress will be made if we fix certain broad aims. As I see them they include:
>
> 1. Knowledge of earthquakes, place of occurrence, frequency and intensity--accurate information of this sort is fundamental.

2. Cause of earthquakes--this includes combination of observational data and theory, the observational data to include both observations of near and distant earthquakes;

3. Nature of activity in central region--includes both the material needed by the engineer and questions of propagation, the solution of which is urgently needed by the engineer;

4. Knowledge about the interior of the earth--of interest to the astronomer, seismologist, and geologist and derived from both near and distant earthquake records;

5. Simulation of earthquakes to study effects on structures--accuracy of simulation and the question of relation of models to full-size structures is in the field of the engineer."--W. Ayvazoglou.

THE THERMAL AND ELASTIC PROPERTIES OF ELINVAR: A STUDY OF AN ELINVAR SPRING IN THE GALITZIN VERTICAL SEISMOGRAPH AT KEW OBSERVATORY

By F. J. Scrase

Journal of Scientific Instruments, vol. 6, No. 12, 1929, pp. 385-392.

In discussing the results of a study of an Elinvar Spring in the Galitzin vertical seismograph, the author says:

> A serious defect of the Galitzin vertical seismograph is the drift of the pendulum which is caused by the effect of temperature changes on the elasticity coefficient of the steel spiral spring. In order to overcome this disadvantage an elinvar spring was recently fitted to the vertical seismograph at Kew Observatory. After loading the spring, the 'creep' remained appreciable for several months. Moreover the rate of 'creep' was dependent on the temperature. After making due allowance for these effects it was found that the temperature coefficient of the elastic constant of the elinvar spring was about one-tenth of that of the steel spring.

Data on the dimensions of springs (elinvar and steel), determinations of elastic constant and description on the seismograph observations are given.

The results, applied to the elinvar spring when under a load of about 40 kilograms, are summed up by the author as follows:

(a) The extension under an added weight of one gram is 0.0043 millimeters, that is, 0.0027 per cent of the unstretched length.

(b) The extension under an increase in temperature of $1^{\circ}C$. is 0.0038 millimeters, that is, 0.0024 per cent of the unstretched length.

(c) The rate of creep at the end of one month from the time of loading is of the order of 0.01 millimeter per day. At constant temperature it decreases inversely as the time.

(d) It has not been possible to give any reliable information about the effect of temperature on the rate of creep in the early stages, but the following figures show the effect at the end of six months:

At 5°C. the rate of creep is 0.00047 millimeters per day
At 10°C. the rate of creep is 0.00058 millimeters per day
At 15°C. the rate of creep is 0.00088 millimeters per day.

In the last part of the article the author discusses the practical advantages resulting from using the elinvar spring.--W. Ayvazoglou.

NATURE OF CERTAIN DISCONTINUITIES IN THE EARTH

By Reginald A. Daly

Bulletin of the Seismological Society of America,
vol. 20, No. 2, 1930, pp. 41-52.

Four different kinds of experimental evidence suggests that the seismically effective compressibility of a rock is of the order of one-fifth less than its compressibility as determined by the high-pressure method. Additional specially designed experiments to test this idea are urgently needed. As it stands, the tentative conclusion implies that the crystalline Sial of a continental block is essentially granitic down to a depth not far from 30 kilometers. Below that shell a second shell of granodiorite or quartz diorite is indicated. At the depth of about 45 kilometers is a major discontimuity, which, interpreted on the same basis, represents the interface between the second shell and crystalline basalt, or gabbro. According to Gutenberg's hypothesis, this third shell contacts with a fourth underlying shell of vitreous basalt, the thickness of which is not now to be readily determined from the wave velocities in depth. So far as seismological evidence goes, that thickness may possibly approach 1,200 kilometers. A shell of either crystalline or vitreous peridotite near the earth's surface is not suggested by the wave velocites. The master discontinuity at the depth of 2,900 kilometers seems capable of at least two different explanations.--Author's abstract.

PROGRESS IN AMERICAN SEISMOLOGY

By A. L. Day

Eastern Section of the Seismological Society of America,
Proceedings of the 1930 Meeting, Washington, D. C., pp. 65-70.

A brief historical review of the conditions of seismological work during the last 10 years is given; steps taken for the advancement of this work by organizations interested in seismology are mentioned.--W. Ayvazoglou.

EINE NEUE WÜRTTEMBERGISCHE ERDBEBENWARTE

(A NEW SEISMIC OBSERVATORY IN WÜRTTEMBERG)

By E. Kleinschmidt

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 370-376.

The author gives a description of the place and of the equipment of the new seismic observatory.

Based on the tests carried out in the observatory it was proved that, notwithstanding its vicinity to the large city, the choice of the observatory site must be considered satisfactory.

Two seismograms by which the specialists may be convinced that the instruments are not affected by the traffic of the city are given.--W. Ayvazoglou.

4. ELECTRICAL METHODS

EARTH-RESISTIVITY SURVEY AT HUANCAYO, PERU

By W. J. Rooney and O. H. Gish

Terrestrial Magnetism and Atmospheric Electricity,
vol. 35, No. 2, 1930, pp. 61-72.

This survey, carried out in the high Andes near the Huancayo (Peru) Magnetic Observatory of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, is one of a series of earth-resistivity surveys made in connection with the study of earth currents at observatories where potential-gradient registration is in progress. The general resistivity of the region and its variation with position, depth, direction of current flow, and rainfall, were determined. All may affect potential records and are indicative of the geological structure.

The resistivity of soil near the surface varied from over 100,000 to less than 2,000 ohm-centimeters, depending on the character of the overburden. The mean values tended to converge to a value around 10,000 ohm-centimeters as earth to depths of 200 to 300 meters was included in the measurements. These results are typical for an underlying structure of sedimentary rocks. A local area of high resistivity (values three times the mean for the region as a whole) was found near one earth-current line and explains the high potential-gradient records obtained from that line. The results were found to be independent of the orientation of the survey lines, indicating that the region is laterally isotropic. The seasonal variation was small and relatively unimportant.--Authors' abstract.

DIE ELEKTRISCHEN METHODEN DER ANGEWANDTEN GEOPHYSIK

(ELECTRICAL METHODS OF APPLIED GEOPHYSICS)

By J. N. Hummel

Special print from the "Handbuch der Experimentalphysik,"
vol. 25, No. 3, 1930, pp. 401-462.

The book contains the description of the theory of the electrical methods:

Chapter I - General fundamental principles:

1. Physical fundamental principles;
2. Technical fundamental principles;
3. Geological fundamental principles;
4. Physical and geological common work.

Chapter II - Investigation of stationary fields (direct current methods

1. Potential functions
    - (a) Fundamental equations and the derivation of the potential;
    - (b) Three auxiliary means for the calculation of the potential;
    - (c) Path of circuit and conductivity.
2. Qualitative determination of the direction (potential line methods)
    - (a) Principle of the potential line measurement;
    - (b) Determination of natural sources of the current (self-potential method;
    - (c) Determination of conductivity differences;
    - (d) Calculations made on some examples.
3. Quantitative measurements (resistance methods)
    - (a) Determination of the apparent specific resistance (four points method);
    - (b) Measurement of the resistance.

Chapter III - Quasi stationary proceedings (alternating current methods):

1. Induction currents and displacement currents;
2. Fields produced by means of electrodes (galvanic methods)
    - (a) The electromagnetic field;
    - (b) Investigation of the electric field (probe methods);
    - (c) Investigation of the electric field (frame methods).
3. Fields produced by induction (induction methods)
    - (a) Secondary fields;
    - (b) Horizontal circular primary current;
    - (c) Horizontal straight line primary current;
    - (d) Vertical primary circle.
4. Adjusting of the oscillatory circuit.

Chapter IV - Investigation of dynamic proceedings (wave methods):

1. Hertz's radiation equation for a pair of electric poles (dipol);
2. Reaction upon the exciter of the field
    - (a) Influence of horizontal layers upon a horizontal dipol;
    - (b) Measurement of the damping (quarter-wave method).
3. Measurement of field intensity;
    - (a) Determination of absorption (absorption methods);
    - (b) Determination of interference (reflection methods).
4. Determination of polarization condition
    - (a) Determination of the plane of polarization;
    - (b) Determination of ellipticity.

Thirteen diagrams illustrate the article.--W. Ayvazoglou.

BUSHVELD, TRANSVAAL, SOUTH AFRICA - SUMMARIES OF RESULTS FROM GEOPHYSICAL SURVEYS

By R. D. Hoffman

The American Institute of Mining and Metallurgical Engineers.
Technical Publication No. 369, 1930, p. 15.

The author briefly summarizes his ideas concerning electrical surveying based on prospecting work carried out by a company in Bushveld, Transvaal, South Africa. He says:

1. Unless there is a detailed geological surface map and, if possible, one of the underlying rock structure, plus a competent engineer who is qualified to interpret results, in all likelihood the work will prove ineffective.

2. Unless the character of the ore and the size of the deposit or deposits lend themselves to electrical prospecting, the survey is of little use.

In a country like northern Canada, where there is heavy overburden, high cost of labor and a water level close to the surface--factors which make for expensive trenching--an electrical survey to extend the boundaries of a known deposit or deposits may well be conducted. In South Africa, however, were trenching costs are very low, because there is little water trouble and cheap negro labor, such a survey, in most cases, would be unwise.---W. Ayvazoglou.

5. RADIOACTIVE METHODS

GAMMASTRAHLEN AN KALIUMSALZEN

(GAMMA RAYS ON POTASSIUM SALTS)

By Werner Kohlhörster

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 341-358.

A weak, very hard γ-radiation from potassium salts has been discovered. Its capacity of penetration is about twice as much as that of radium - C - γ-rays but its intensity is only 5.10^{-11} times of that of the same rays; this was determined by measurements of the ionization strength of equal amounts of the substance. The radiation is in direct proportion to the content of potassium and must be assigned to the potassium atom, probably to K_{41}. Owing to the fact that potassium salts are found in comparatively high concentration and are widely distributed they represent a geophysical factor the importance of which must be considered equal to that of radium.

A great number of articles of reference are mentioned.--Author's abstract translated by W. Ayvazoglou.

WIE TIEF DRINGEN DIE POLARLICHTER IN DIE ERDATMOSPHÄRE EIN?

(HOW DEEP DO THE POLAR LIGHTS PENETRATE INTO THE EARTH'S ATMOSPHERE?)

By Carl Störmer

Zeitschrift fuer Geophysik, vol. 6, No. 4-7, 1930, pp. 334-341.

The deepest aurora borealis measured by photograms penetrate into the earth's atmosphere to an altitude of approximately 80 to 82 kilometers. A typical occurrence observed on the night of February 26 to 27, 1929, is examined; six photograms taken with the length of the basis line equal to 65.7 kilometers are given. The mean altitude of the lower border of the band of the aurora borealis was 82.4 kilometers. The possibility of the penetration of the rays of aurora borealis to the surface of the earth and their relationship to penetrating radiation is discussed.--Author's abstract translated by W. Ayvazoglou.

PENETRATING RADIATIONS

By Ernest Rutherford

Proceedings of the Royal Institution of Great Britain,
vol. 26, No. 123, 1929, pp. 87-89.

In recent years there has been a rapid growth in our knowledge of new types of electromagnetic radiations of very short wave lengths which are able to penetrate great thicknesses of matter before they are absorbed. The discovery of X-rays, which correspond to light waves of very short wave length, opened up a new field of study, and this was further widened by the discovery that radium and other radioactive bodies emitted radiations of the same type, but of a far greater power of penetration. A still further extension of our ideas had come from the proof that there exists in our atmosphere a type of ultra-penetrating rays, often called the cosmic rays, of about 100 times the penetrating power of gamma rays. The frequency of vibration of these cosmic rays is from 100 to 1,000 million times greater than that of ordinary light.

The main factors which control the absorption of these radiations are now well understood. For ordinary X-rays the quantum of radiation in passing through the atoms of matter occasionally collides, or rather interacts, with one of the component electrons, and the whole wave energy of the quantum is given to the electron, which is set in rapid motion and ionizes the matter in its path. The chance of such a conversion of the energy of the radiation, called the photo-electric effect, increases rapidly with the weight of the atom, and falls off markedly as the frequency of the radiation is raised. It is for this reason that, weight for weight, heavy elements absorb X-rays much more easily than light elements.

Another process, called scattering, which leads to loss of energy from the radiation, is also always present. The effect of this is small for ordinary X-rays, but becomes predominant for very high frequency rays, and indeed controls the absorption. In this scattering process, called the Compton effect, there is a peculiar type of interaction between the quantum and the electron which differs markedly from the photo-electric effect. The radiation is scattered, and at the same time the electron is set in motion. The scattered radiation is degraded in frequency in amount depending on the angle of scattering. In very penetrating rays the average frequency of the scattered wave is reduced to about one-half for each scattering collision, and about half the energy on the average is given to the recoil electron. Consequently when a very penetrating radiation passes through matter recoil electrons of high speed and degraded radiations are always present.

A number of experiments were shown to illustrate the laws of absorption of penetrating radiations of the X-ray and γ-ray types. A new method devised by Professor H. Geiger for detecting and counting the individual recoil electrons produced by the penetrating radiations in our atmosphere was shown in operation.

The experimental information is at present too scanty to fix with certainty the origin and nature of these extraordinarily penetrating rays. It has been suggested that they come from outer space, and represent radiations which arise in the destruction on creation of atoms. The energy of the quantum in the most penetrating radiation measured by Millikan is of the order of 1,000 million volts. It may prove significant that radiation of this energy may be expected to arise if the proton can be converted into radiation by a single catastrophic process. Some time ago Jeans suggested that the transformation of protons and electrons into the energy of radiation appeared to be necessary in order to account for the long lives of the hot stars.--Author's abstract.

RADIOACTIVITY A TOPIC OF TO-DAYS GEOPHYSICS

By J. Korzujin

Boletin de la Asociacion Geofisica de Mexico,
vol. 1, No. 10-11-12, 1930, pp. 179-186.

In the first part of this article the author gives a brief review of the different geophysical methods of prospecting, pointing out some of the defects inseparable from certain methods.

The main part of the article consists of a discussion of the radioactive method of prospecting, which in the opinion of Korzujin must be considered to be the most up-to-date method.

Some accomplishments of scientists involved in investigations of radio-activity are mentioned; a few figures illustrate graphically the results obtained by radiometric investigations in several cases.

The article is published in Spanish and English.--W. Ayvazoglou.

RADIOAKTIVE METHODEN

(RADIOACTIVE METHODS)

By J. N. Hummel

Special print from the Handbuch der Experimentalphysik,
vol. 25, No. 3, 1930, pp. 519-539.

The pamphlet is divided into the following chapters and paragraphs:

Chapter 1 - Importance of radioactivity for Geophysics.

Chapter 2 - Geological and physical elements of the radioactive exploration work.

- (a) Radioactive content and radioactivo distribution in the earth's crust;
- (b) Influence of radioactive decomposition upon radioactive distribution.

Chapter 3 - Measuring methods and measuring instruments.

Chapter 4 - Methods of exploration and their practical results:

- (a) Investigation by measuring the activity of samples of the material;
- (b) Investigation by measuring the whole radiation of the soil;
- (c) Investigation by measuring the hard penetrating earth-radiation;
- (d) Investigation by measuring the emanation content of the ground air.

Eight figures and a number of articles of reference are added.--W. Avvazoglou.

7. UNCLASSIFIED METHODS

KENNECOTT MINES, ALASKA - SUMMARIES OF RESULTS FROM GEOPHYSICAL SURVEYS

By Allen M. Bateman

The American Institute of Mining and Metallurgical Engineers,
Technical Publication No. 369, 1930, pp. 7-11.

In this article Bateman expresses his opinion on the applicability of geophysical methods of prospecting, based on the results obtained from an electrical and electromagnetic survey carried out at Kennecott. Conclusions drawn by him are briefly summarized as follows:

1. - Geophysical methods are under ordinary conditions an extreme valuable adjunct to geological work in ore finding. The two, however, can not be separated.

2. - Geophysical work in mining regions has its value chiefly in surveying specific areas in which mineralization is strongly suspected, as in the vicinity of known ore bodies or in potential ore areas. The author is not convinced that the expense and slowness of the work justify it for blind prospecting in areas that might be favorable but in which no ore is known.

3. - Geophysical work is not sufficiently standardized to convince the mine operator that negative areas contain nothing and that indicated conductors mean ore.

4. - For certain types of work some of the companies should do more experimentation of their own in the field in order to know whether their methods are adaptable to certain types of deposits, before they accept such work under fee.--W. Ayvazoglou.

GULL LAKE, NORTH CENTRAL NEWFOUNDLAND - SUMMARIES OF RESULTS FROM GEOPHYSICAL SURVEYS

By E. Y. Dougherty

The American Institute of Mining and Metallurgical Engineers,
Technical Publication No. 369, 1930, pp. 15-21.

Geological conditions of the region are described and shown in a figure. It was concluded that the highly electrically conductive ore mineral chalcopyrite, associated with the magnetic mineral pyrrhotite, presented favorable conditions for the effective joint use of electrical and magnetic surveys. Two main objectives were in mind:

(1) To locate and outline possible extensions of the known ore bodies;

(2) To locate new ore bodies, particularly ore bodies other than the known ore bodies that might be the source of the ore bowlders.

Based on the results two drill holes put down on the Mineral Point southwest extension to verify the electrical indications demonstrated the efficacy of the equipotential method in locating conceled zones of conductivity in this area; but in spite of the joint use of electrical and magnetic surveys, under favorable conditions, it was impossible to predict whether certain indications resulted from a concentration of chalcopyrite sufficient to make ore or merely from noncommercial sulphides.

Magnetic reactions were due in part to pyrrhotite and in part to magnetite and did not necessarily indicate important concentrations of associated chalcopyrite.

Electrical indications were pronounced over uncommercial sulphides as well as over ore. The fundamental limitations of geophysical surveys were evident, therefore.

The geophysical survey having for its object the location of unknown ore bodies gave no certain evidence of the efficacy of the methods used.

The author concludes that negative results might be attributed to the inability of the methods to locate conductive zones under a considerable covering of lake water or glacial overburden, but a fairer conclusion is that no strong conductive zones exist in the areas prospected.--W. Ayvazoglou.

SOUTHERN BRITISH COLUMBIA - SUMMARIES OF RESULTS FROM GEOPHYSICAL SURVEYS

By J. J. O'Neill

The American Institute of Mining and Metallurgical Engineers,
Technical Publication No. 369, 1930, pp. 12-14.

The author describes briefly his experience concerning geophysical prospecting carried out in Southern British Columbia by two companies and draws the conclusion that there has to be a great deal more standardization in interpretation of results. If properly applied, assistance can be obtained from geophysical methods of prospecting, but so far at least results have not been interpreted in such a way as to gain much confidence.--W. Ayvazoglou.

CURSUS IN ANGEWANDTER GEOPHYSIK BEI DER REICHSANSTALT FUER ERDBEBENFORSCHUNG IN JENA VOM 7 BIS 12 APRIL, 1930

(COURSE OF LECTURES IN APPLIED GEOPHYSICS AT THE REICHSANSTALT FUER ERDBEBENFORSCHUNG IN JENA FROM APRIL 7 TO 12, 1930)

By H. Werner

Kali und verwandte Salze, vol. 24, No. 12, 1930, p. 192.

Owing to the great interest shown during the last 10 years in geophysical methods of prospecting, the Reichsanstalt für Erdbebenforschung (Institute of Seismological Research) in Jena offered a one-week course of lectures to a limited number of persons having the necessary knowledge of geophysics in general. A lecture on a special method was usually delivered in the morning and its practical application in the field was carried out in the afternoon.

In consideration of the great success of this undertaking the course will probably be repeated.--W.Ayvazoglou.

A BRIEF REVIEW OF ARTICLES APPEARING IN VOLUME 1, NOS. 10, 11, AND 12 OF THE "BOLETIN DE LA ASSOCIACION GEOFISICA DE MEXICO"

Boletin de la Associacion Geofisica de Mexico,
vol. 1, Nos. 10, 11, and 12, 1930, pp. 155-219.

1. The physical principles of the gravitational method of prospecting, by B. P. Nikiforov. The continuation of the Russian article translated into Spanish is given on pages 201 to 205. The first part of the same article is also given in English translation (pp. 174-178). Both translations are made by Prof. J. Korzujin.

2. Geophysical methods of prospecting, by Georges A. Boutry. Continuation of the French article translated into Spanish by L. Urguijo, Eng. (An abstract of Boutry's article was published in Geophys. Abs. No. 8).--W. Ayvazoglou.

NUMEROUS GEOPHYSICAL PROSPECTS PROVE DISAPPOINTMENTS

By Jack Logan

The Oil Weekly, vol. 58, No. 7, 1930, pp. 136-137 and 276.

In this article Logan discusses the results of drillings accomplished during the first half of 1930 on numerous geophysical prospects in both the Texas and the Louisiana divisions of the Gulf Coast. These prospects are given in an accompanying table in which mostly recent discoveries made with both seismograph and torsion balance are included. The purpose of the table is to demonstrate that the development of these new prospects, interpreted in many instances as deep domes or other unfamiliar structures, is not attended with the phenomenal success marking early drilling on older geophysical discoveries consisting largely of shallow domes. On some of the later the first well yielded oil, and in numerous cases the first test encountered cap rock or salt. By reason of the slight promise offered by these recently tested areas, enthusiasm has died down greatly in the search for additional prospects.--W. Ayvazoglou.

IN DEFENSE OF GEOPHYSICS

By John F. Weinzierl

The Oil Weekly, vol. 58, No. 11, 1930, p. 46.

Answering the recent criticism of geophysical methods of prospecting, Weinzierl writes:

> Critics must concede remarkable accomplishments by successful geophysical methods. Reputable geophysicists have as a whole been cautious in making reports. However, there have been times when a company was willing to develop some peculiar anomaly not falling under the category of known geophysical structures. These must be regarded as experiments and not thrown up to the geophysicists as blunders,

Differences in opinions and differences in methods of interpretation have caused disagreements as to geophysical discoveries. This, however, is the case in all exploratory work and is not peculiar to geophysics. As a whole, geophysicists have an enviable record. In fact, geophysicists set about to spoil the oil profession by producing such fields as Sugarland, Port Neches, Van, etc., with initial well production. Hence the disappointment when other areas do not produce with the first well. Give geophysics time and it will richly reward the patient considerate operator. It must be remembered that some form of geophysical picture can be had of any area. Should the time come for oil production from sand conditions other than our present structures, even then the geophysicist can give an interpretation from his more detailed work of an area. All in all, things are not so bad with geophysics, and critics had better withhold their opinion until more time has elapsed. They should be patient enough to give half as much time for the thorough testing of the geophysical anomalies as was accorded other previously discovered structural conditions.--W. Ayvazoglou.

9. NEW BOOKS

Abetti, G., and Alessio, A. Geofisica, gravita e magnetismo (geophysics, gravity and magnetism). Report of the scientific results of the De Filippi Italian Expedition to the Himalaya and Karakorum Mountains in Kashmir and Turkestan, 1913-1914. Series 1, vol. 2, Bologna, Nicola Zanichelli, 1929, 222 pages, 38 tables.

American Institute of Mining and Metallurgical Engineers, Inc. Petroleum Development and Technology, 1930. 29 West 39th Street, New York, N. Y. (1930). 610 pages, illustrated, cloth. Price. $5.

Das Erdöl, Fourth volume (of five) of the second edition of the great Engler-Höfer work. The present edition is under the general editorship of Dr. J. Tausz, who is assisted by a large number of collaborators. The fourth volume deals with chemical, physical, geological, and geophysical methods of research (Dr. A. Moos). 615 pages and 225 illustrations. Price: 68 marks paper and 71 marks linen bound. Verlag von S. Hirzel, Leipzig, C 1.

Gutenberg, B. - Lehrbuch der Geophysik (Textbook of Geophysics). With the cooperation of Ansel, Bartels, Benndorf, Born, Linke, Sieberg, Wegener, and Weickmann. 1,017 pages. The book is divided into 18 sections and 86 chapters. Published by Gebrüder Bornträger, Berlin.

Meissner, O. - Beiträge zu einer experimentellen Seismik (Contributions toward an experimental seismology). Veröffentlichungen der Reichanstalt fur Erdbebenforschung in Jena. Heft 9, 1929, 77 pages. Published by Verlag von Gustav Fischer in Jena.

Sarnetzky, H. - Grundzüge der Luft-und Erdbildmessung (Fundamentals of surveying by aerial and ground photography). 236 pages. Published by Gebrüder Bornträger, Berlin, 1928, price 12 marks.

10. PATENTS

1. GRAVITATIONAL METHODS

1,729,836 Patented Oct. 1, 1929.

TORSION BALANCE

Karl Kilchling, Freiburg, Germany

The invention relates to improvements in torsion balance of the Eötvös type. When effecting gravity measurements with a torsion balance of this type a fundamental requirement is that the torsion axis be adjusted vertically very accurately. The new arrangement and combination of parts renders the levelling superfluous, in that the balance adjusts itself automatically.

Claims allowed - 8.

1,733,407 Patented Oct. 29, 1929.

TORSION BALANCE FOR MEASURING DIFFERENCES OF GRAVITY

Hans Haalck, Berlin-Steglitz, Germany

In this invention the form of the beam is such as to simplify the construction of the whole apparatus and to afford a convenient handling of the instrument without disturbing its sensitiveness.

Claims allowed - 6.

1,737,660 Patented Dec. 3, 1929.

THREE-WEIGHTED TORSION BALANCE

Ervand Kogbetliantz, Paris, France

By increasing the number of beams the number of observations necessary in one point is reduced. As to the execution of such a balance, it is entirely similar to the usual Eötvös balance with two weights.

Claims allowed - 3.

1,747,651 Patented Feb. 18, 1930.

TORSION BALANCE FOR MEASURING THE GRAVITATION

Wilhelm Schweydar, Potsdam, Germany

A means is presented by which the balance beam is prevented from turning around its own axis, and by which the vertical rods are prevented from tilting to one or the other side.

Claims allowed - 7.

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1,773,032 Patented Aug. 12, 1930.

TORSION BALANCE

Malcolm Dunbar, London, England

This invention is chiefly directed toward the provision of a more convenient optical indicating and registering system, an important feature of which is the arrangement in the system of a fixed graduated index or scale, the image of which is reflected by the mirror on the bar so that it can be read through a conveniently situated sight aperture furnished with a cross wire or other datum mark. This arrangement enables direct readings of the deviations of the bar to be taken in numerical values and thus determination of the readings by the measurement of charts or diagrams is avoided.

Claims allowed - 12.

1,774,516 Patented Sept. 2, 1930.

TORSION BALANCE FOR GRAVITATIONAL MEASUREMENTS

Karl Kilchling, Freiburg-im-Breisgau, Germany

The method according to this invention aims at shortening the observation time required for a station, as well as to render the circumstantial computation superfluous. The basic idea of the method consists in ascertaining the deflection of the suspended attraction members not only in five azimuths, but in all, and to render it possible to read directly the direction and the magnitude of the gradient from the numerical values and the graphic representation of the same after one preceding gaging of the scale.

Claims allowed - 11.

2. MAGNETIC METHODS

1,748,659 Patented Feb. 25, 1930.

METHOD AND APPARATUS FOR MAGNETIC PROSPECTING

Karl Sundberg, Stockholm, Sweden

An artificial magnetic field is established in the earth by use of a direct current passing through a closed loop laid out on the earth's surface, and determinations are made by measurements with respect to said field.

Claims allowed - 5.

3. SEISMIC METHODS

1,738,094 Patented Dec. 3, 1929.

SOUND LOCATING APPARATUS

George A. Caldwell, of Milton, and C. Birchall, of Reading, Mass.

This apparatus comprises a pair of geophones connected by tubes with ear pieces. The apparatus takes advantage of the principle that the ear recognizes the direction from which sound comes. In using the apparatus the two geophones are moved about against the surface through which the vibrations are coming, until a point is found where the sounds have the same intensity in both ears. The direction in which the sound comes will be perpendicular to a line connecting the two geophones.

Claims allowed - 8.

1,743,358 Patented Jan. 14, 1930.

METHOD OF LOCATING SALT OR ROCK LAYERS

Johann G. Koenigsberger, Freiburg, Germany.

The present invention refers to a method of determining the situation and form of salt deposits, gravel and rock layers, and the like. It is based on the use of acoustic waves and electroacoustic apparatus to record these waves and makes use of the modern sound-detecting apparatus, with or without amplifier tubes connected with oscillograph tubes or other recording devices, or without such the novel object as regards the use of acoustic waves being the locating of salt deposits, the extension of the boundaries of layers of gravel, and the like.

Claims allowed - 4.

4. ELECTRICAL METHODS

1,775,502 Patented Sept. 9, 1930.

APPARATUS FOR MEASURING EARTH RESISTANCES

Manfred Schleicher, Berlin-Charlottenburg, Germany

This invention relates to an apparatus for measuring earth resistance and diffusion resistance of the type of the so-called zero method; that is, the apparatus includes a circuit with an indicating device having a scale, and proper adjustment is made until no current flows in such circuit and the indicating device therefore points to zero. This invention has for its object to provide an apparatus operating to the zero method but avoiding the drawbacks which have so far interfered with the satisfactory use of zero-method apparatus.

Claims allowed - 3.

INDEX

Page

Abetti, G. 25
Accelerometer for use in a seismic region 8
Alessio, A. 25
American Institute of Mining and Metallurgical Engineers 25

Bateman, Allen M. 20
Boletin de la Asociacion Geofisica de Mexico 23
Bushveld, Transvaal, South Africa; summaries of results from geophysical surveys 17

Čechura, Fr. 4

Daly, Reginald A. 13
Day, A. L. 13
Discontinuities in the earth, nature of 13
Dougherty, E. Y. 21

Earthquakes, a joint problem of the seismologist and engineer 11
    near, table of travel-times for 9
Earth's gravity in powers of the square of the sine of the latitude, on the expansion of the 2
Electrical methods of applied geophysics 15
Elinvar, thermal and elastic properties of: A study of an elinvar spring in the Galitzin vertical seismograph at Kew Observatory 12

Gamma rays on potassium salts 17
Geomagnetic investigation of Algonkian contact deposits and granites in Pribrame 4
Geophysical prospects prove disappointments 23
Geophysics, in defense of 23
Gish, O. H. 14
Gravitational effect on the intermediate layers, the dependence of the . 2
Gull Lake, North Central Newfoundland: Summaries of results from geophysical surveys 21
Gutenberg, B. 25

Heck, N. H. 11
Hoffmann, R. D. 17
Hotchkiss Superdip, practical geomagnetic exploration with the 3
Hummel, J. N. 15,20

Induction-magnetometer, universal 5

Jena, Reichsanstalt fuer Erdbebenforschung, lectures in applied geophysics 22

Page

Joliat, J. S. 9

Kennecott mines, Alaska: Summary of results from geophysical surveys .. 20
Kleinschmidt, E. 14
Kohl, E. 4
Kohlhörster, Werner 17
Korzujin, J. 19
Kühl, W. 7

Leet, L. Don 10
Logan, Jack 23

Magnetic charts, construction of 6
Magnetic disturbance at different stations, comparison of 6
Magnetic disturbance effect of iron bodies and iron masses 4
Manila Observatory, installation of new seismographs 11
McAdie, Alexander 8
McComb, H. E. 11
McFarland, W. N. 6
Meissner, O. 25
Mineo, Corradino 2

New Mexico, Lea County, magnetometer results in 7

O'Neill, J. J. 22

Patents 26,27,28
Peru, Huancayo, earth-resistivity survey 14
Petroleum Development and Technology, 1930 25
Polar lights, depth of penetration into the earth's atmosphere 18

Radiations, penetrating 18
Radioactive methods 20
Radioactivity a topic of to-days geophysics 19
Rayleigh-wave records on seismograms of distant earthquakes, some characteristics of 10
Repetti, W. C. 11
Rooney, W. J. 14
Rutherford, Ernest 18

Sarnetzky, H. 25
Scale for earthquake intensity 8
Schlomka, Teodor 2
Scrase, F. J. 12
Seismology, American, progress in 13
Sound wave, on the form of distant 7
South Africa, Bushveld, results of geophysical surveys 17
Southern British Columbia: Summaries of results from geophysical surveys 22

Page

Spraragen, L. 7
Stearn, Noel H. 3
Störmer, Carl 18

Tilt-compensation seismometer 11

Uljanin, W. 5

Wallis, W. F. 6
Weinzierl, F. 23
Wenner, Frank 8
Werner, H. 22
Wurtemberg, a new seismic observatory in 14